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NATIONAL RESEARCH COUNCIL

RESEARCH COMMITTEES IN EDUCATIONAL INSTITUTIONS

A very large proportion of the scientific research of the United States is conducted in the laboratories of educational institutions. It is now widely appreciated that contact with knowledge *in the making* is the most effective means of seizing and holding the student's attention. And it is also recognized that no greater injury can be done to the cause of science than to compel a promising investigator, fresh from the researches of his graduate years, to relinquish all hopes of further studies because of the complete absorption of his time and energy by other duties.

It is with the fullest appreciation of the difficulties which financial limitations involve, and with a sincere desire not to interfere with the just demands of the teacher's profession, that the National Research Council invites the coöperation of educational institutions in the promotion of research at this critical period in our national progress. We believe it to be feasible, without decreasing the efficiency of the university, the college, or the professional school as teaching institutions, to increase greatly their contributions to knowledge through research. Indeed, we do not hesitate to say that if a portion of the time now given to teaching were devoted to investigation, and if the courses of instruction were so altered as to take full advantage of this change, the educational efficiency of the institutions in question would be materially enhanced. In extending a request for the formation of Research Committees in educational institutions of high standards, which accord serious support to scientific research undertaken by the faculty and advanced students, we beg to call attention to some of the possibilities which lie open to committees of this character.

In view of the importance of encouraging research on the part of members of the faculties of colleges which do not undertake graduate instruction, the invitation of the Council is not limited to universities and other institutions now giving specific recognition to research. It is highly important to encourage competent men to continue the work of research begun in their university career, and a sympathetic Research Committee could help greatly in this respect. Even the existence of such a committee should serve as a valuable stimulus to men who properly look for some measure of encouragement. In small institutions, as an illustration cited below will indicate, powerful support can be given to research by a body of men who genuinely appreciate its significance.

Each Research Committee will doubtless discover its own best method of procedure, adapted to the circumstances of the case. The following suggestions, which embody the results of the discussions of the Council's Com-

mittee on Research in Educational Institutions, may nevertheless be of service in organizing the work of the committees.

(1) It will probably be advantageous to begin by preparing a survey of the research already in progress in the institution in question. This should serve to indicate the possibilities of extending existing work, and point out favorable opportunities for initiating new lines of investigation.

(2) The Research Council will shortly undertake the preparation of a National Census of Research, indicating the equipment for research, the men engaged in it, and the lines of investigation pursued in government bureaus, educational institutions, research foundations, and industrial research laboratories. The purpose of the Census is to provide data for the effective development of research in pure science and in the industries, as well as for strengthening the national defense. The various Research Committees in educational institutions can aid the Council materially in securing data for the Census, and in supplying information for annual surveys of the progress of scientific research in the United States.

(3) One of the great problems of research laboratories is to find suitably trained men to carry on their work. Nearly all of these men come from educational institutions, where every available means should be used to increase the supply. If research is encouraged on the part of faculty members, and if its national importance is frequently impressed upon the students, more of them will be impelled to follow the career of investigators. The tendency toward narrow specialization, so common at present, should be counteracted by developing more interest in science as a whole. Lectures on the history of science, and broad courses on evolution, covering its various aspects, from the constitution of matter and the evolution of stars and the earth, to the rise of man and the development of civilization, should be widely encouraged. From the purely educational viewpoint such courses may be expected to produce a more favorable influence and leave a more lasting impression than routine discussions of the minutiae of the various branches of science, though the latter are obviously essential in the training of the investigator.

(4) The Council wishes to develop a wider appreciation of the part which men of science may play in researches bearing both on industrial progress and national defense, including those of ship design, aeronautics, the fixation of nitrogen, and many other subjects. Various committees of the Council will soon be prepared to furnish information regarding such research problems.

(5) The development of more general coöperation and coördination in research, within each educational institution and in alliance with other workers outside, is another important subject for consideration. It is essential to remember, however, the necessity of safeguarding the personal freedom and the individual initiative of all investigators.

(6) The interchange of research workers, especially to secure for the smaller

institutions the stimulus given by leaders of research, should be strongly encouraged.

(7) The establishment of a large number of research fellowships, each yielding one thousand dollars or more annually, is very desirable. If students showing special aptitude in their work for the doctor's degree could thus be enabled to devote themselves to research for a year or more, their future career as investigators might be assured. Research fellowships may be conferred by colleges on graduates who have taken their doctor's degree elsewhere, or used to secure the services of non-graduates in research laboratories.

(8) The time is also opportune to secure the establishment of research professorships and research endowments. The present appreciation of the national importance of research, and the increasing sense of personal obligation to the state, will cause men of means to contribute more freely than ever before.

(9) Most important of all is the encouragement of the *spirit* of research, and the development of a sympathetic atmosphere in which the investigator can work to the best possible advantage.

Large institutions should easily be able to extend their research activities, but smaller ones may encounter greater difficulties. As a practical example of what can be done by small institutions in the promotion of the objects of the National Research Council, some results accomplished since June by Throop College of Technology, at the direct instigation of the Council, may be cited. The steps it has taken in connection with the work of the Council are as follows:

Passage by the board of trustees of a resolution endorsing the objects of the Research Council and promising coöperation and of a second resolution providing that in the event of war with a first-class power all available research men and facilities required for the solution of problems of national defense or public need may be counted upon by the Research Council.

Provision of a new fund of two hundred thousand dollars as an endowment for research in physics.

Appointment of Dr. Robert A. Millikan as Director of the Physical Laboratory (under an arrangement with the University of Chicago by which he is to spend a part of each year in Pasadena).

Organization of a coöperative attack on electron problems from the physical, chemical, and astronomical standpoints, in which the physical and chemical laboratories of Throop College and the Mount Wilson Solar Observatory will take part.

Provision of three research fellowships, yielding one thousand dollars each annually, to be awarded to men who have shown exceptional ability in their research work for the doctor's degree. (Beloit College has also established, for a period of five years, a research fellowship yielding one thousand dollars annually.)

Provision of a wind tunnel and well equipped aerodynamical laboratory for researches on the structure of aeroplanes.

Participation in a coöperative arrangement permitting the repetition at Throop College of Professor Michelson's experiment on the tides within the body of the earth, to determine the possible influence of oceanic tides, and to serve as a part of the general study of Pacific Ocean problems undertaken by a committee of the National Academy of Sciences.

CENTRAL COMMITTEES ON RESEARCH

The National Research Council, with the coöperation of the American Association for the Advancement of Science, the American Chemical Society, the American Physical Society, the American Mathematical Society, and other national scientific societies, has established a series of central committees to organize research in the various branches of science.

The purpose of these committees may be outlined as follows:

(1) To join in the preparation of the National Census of Research. This will be taken by the Census Committee of the Research Council, of which the Chairmen of the various central committees are members.

(2) To prepare reports embodying comprehensive surveys of the larger possibilities of research in the various departments of pure science, suggesting important problems and favorable opportunities for investigation.

(3) To survey the economic and industrial problems of the United States, and report on possible means of aiding in their solution by the promotion of research in the fields represented by the various committees. (In coöperation with the Council's Committee on the Promotion of Industrial Research.)

(4) To indicate how investigators in each committee's field can aid in the solution of research problems involved in strengthening the national defense. (In coöperation with the Military Committee of the National Research Council.)

(5) To point out opportunities, national and international, for coöperation in research, and to assist in the coördination of the various agencies already established for this purpose.

(6) To keep in touch with the Research Committees of educational institutions, and to supply research problems, suggestions, or thesis subjects when requested to do so.

(7) To serve as a national clearing house of information regarding research problems in each committee's field which arise from scientific, industrial, and other sources, and are communicated to the Council by local Research Committees or other agencies.

(8) To promote research by such other methods as may prove advisable, including the encouragement of such courses of instruction in educational institutions as are best adapted to develop greater breadth of view, a wider understanding of the methods of research, and a more general perception of the national importance of all forms of research, both in pure and applied

science; the more effective use of existing research funds; the establishment of research fellowships, research professorships, and research endowments.

All reports of the National Research Council and of its committees are published in full in these PROCEEDINGS, through which members of the separate committees may keep in touch with the work in progress in all its various fields.

GEORGE ELLERY HALE, *Chairman*.

NATIONAL RESEARCH COUNCIL

REPORTS OF MEETINGS OF THE EXECUTIVE COMMITTEE

The seventh meeting of the Executive Committee of the Research Council was held at the office of the Council, New York City, on December 18, 1916. Messrs. Carty, Chittenden, Conklin, Dunn, Noyes, Pupin, Stratton, Vaughan, Welch, and the Secretary were present; also Mr. M. T. Bogert, Chairman of the Chemistry Committee.

The Secretary reported that the President of the Academy had appointed Howard E. Coffin, William M. Davis, and Franklin H. Martin, members of the Council; and that the Chairman of the Council had appointed R. H. Chittenden and R. A. Millikan members of the Executive Committee.

A communication from the Chairman of the Council was presented stating that the Massachusetts Institute of Technology, Yale University, the University of Chicago, Northwestern University, and Throop College of Technology, had appointed Research Committees, constituted as follows:

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Richard C. Maclaurin, *president*; John R. Freeman, Francis R. Hart, Everett Morss, A. D. Little, C. T. Main and Jasper Whiting, *from the Corporation*; Charles R. Cross, Harry M. Goodwin, Arthur E. Kennelly, Warren K. Lewis, Waldemar Lindgren, Arthur A. Noyes, Joseph C. Riley, George C. Whipple, and Edwin B. Wilson, *from the Faculty*; and George E. Hale and Willis R. Whitney, *from the Alumni*.

YALE UNIVERSITY

Arthur T. Hadley, *president*; Harry G. Day and John V. Farwell, *from the Corporation*; Ernest W. Brown, Russell H. Chittenden, Treat B. Johnson, James F. McClelland, Ernest F. Nichols, and C. E. A. Winslow, *from the Faculties*; and Edwin M. Herr and William W. Nichols, *from the Alumni*.

UNIVERSITY OF CHICAGO

Harry Pratt Judson, *president*; Harold H. Swift, Julius Rosenwald, and Martin A. Ryerson, *from the Board of Trustees*; R. R. Bensley, Thomas C. Chamberlain, John M. Coulter, Albert A. Michelson, Robert A. Millikan, Eliakim H. Moore, and Julius Stieglitz, *from the Faculty*; and Raymond Bacon and Frank B. Jewett, *from the Alumni*.